AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claims 1 - 21 (Canceled).

Claim 22 (New). A method of operating a magnetic resonance apparatus in which magnetic gradient coils are used to generate one or more magnetic field gradients in a working volume so as to define regions from which magnetic resonance signals are obtained in use from a target material; characterized in that,

a set of at least two magnetic gradient coils are provided for producing the magnetic field gradient in a particular direction, and in that, for each of the defined regions, the one or more magnetic field gradients are controlled in accordance with the position of the said region with respect to the gradient coils by controlling the ampere-turns values within the at least two coils of the set independently, so as to apply one or more magnetic field gradients of predetermined uniformity within the region.

Claim 23 (New). A method according to claim 22, wherein the defined regions are arranged as a series of regions, such the combined volume of the regions substantially intersects a target volume of the target material, the target volume being a volume of the target material from which it is desired to obtain the magnetic resonance signals.

Claim 24 (New). A method according to claim 23, wherein the one or more magnetic field gradients applied to a particular region are dissimilar to those applied to an adjacent region.

Claim 25 (New). A method according to claim 23, wherein the magnetic field gradient uniformity within regions at the periphery of the working volume is thereby increased so as to allow improved magnetic resonance signals to be obtained from such regions.

Claim 26 (New). A method according to claim 22, wherein the working volume is arranged to one side of the coils comprising the magnetic resonance apparatus, and wherein the regions are arranged in the working volume.

Claim 27 (New). A method according to claim 22, wherein each region comprises a substantially planar slice.

Claim 28 (New). A method according to claim 22, wherein the method further comprises, within a particular region, controlling the one or more magnetic field gradients in accordance with the location of the target material of interest within that region.

Claim 29 (New). A method according to claim 28, wherein the regions are arranged along a Z axis defining the magnetic field direction of the magnetic resonance apparatus, and wherein, within a particular region, the magnetic field gradients are controlled along an X axis and/or a Y axis, the X and Y axes being substantially orthogonal to the Z axis.

Claim 30 (New). A method according to claim 22, wherein when the region is situated at $z = z'$ then the desired gradient G_z is determined in accordance with the conditions:

$B_z(z') = G_z \cdot z'$ so as to position the slice correctly;

$B_z(z) \neq G_z \cdot z' \text{for} z \neq z'$ over the working volume so as to avoid aliasing; and

$\frac{\partial B_z}{\partial z}\Big|_{z=z'} \approx G_z$ to achieve the correct slice thickness;

wherein $B_z(z')$ is the B field in the z direction at the position z=z′ and wherein the B_0 field is in the z direction.

Claim 31 (New). A method according to claim 30 wherein the gradient is determined in accordance with the condition $\frac{\partial^2 B_z}{\partial x^2} = 0$ so as to eliminate curvature of the region.

Claim 32 (New). A method according to claim 22, wherein when the region is situated at $x = x'$ then the desired gradient G_x is determined in accordance with the conditions:

$B_z(x') = G_x \cdot x'$ so as to position the slice correctly;

$B_z(x) \neq G_x \cdot x' \text{for} x \neq x'$ over the working volume so as to avoid aliasing; and

$\frac{\partial B_z}{\partial x}\Big|_{x=x'} \approx G_x$ to achieve the correct slice thickness;

wherein $B_z(x')$ is the B field in the z direction at the position x=x′ and wherein the B_0 field is in the z direction.

Claim 33 (New). A method according to claim 32 wherein the gradient is determined in accordance with the condition $\frac{\partial^2 B_z}{\partial z^2} = 0$ so as to eliminate curvature of the region.

Claim 34 (New). A magnetic resonance apparatus comprising:

a magnet system for generating a magnetic field in a working volume;

magnetic gradient coils for generating one or more magnetic field gradients in the working volume so as to define regions from which magnetic resonance signals are obtained from a target material; and

a controller for operating the magnetic gradient coils in use so as to apply one or more magnetic field gradients within each region, characterised in that

the magnetic gradient coils comprise a set of at least two magnetic gradient coils for producing the magnetic field gradient in a first direction, and in that,

for each of the defined regions, the controller is further adapted in use to control the one or more magnetic field gradients in accordance with the position of the said region with respect to the magnetic gradient coils by controlling the ampere-turns values within the at least two magnetic gradient coils of the set independently, such that the one or more magnetic field gradients have a predetermined uniformity within the region.

Claim 35 (New). Apparatus according to claim 34, wherein a set of at least two magnetic gradient coils are provided for producing the magnetic field gradient in each of, a second direction, or a second and third direction respectively, wherein for each set the ampere-turns values of at least two of the said coils are independently controllable using the controller.

Claim 36 (New). Apparatus according to claim 34, wherein the working volume is arranged to one side of the coils comprising the magnetic resonance apparatus, and wherein the regions are arranged in the working volume.

Claim 37 (New). Apparatus according to claim 36, wherein the axes for the gradient coils are each arranged along a common direction.

Claim 38 (New). Apparatus according to claim 37, wherein the gradient coils within one set are arranged coaxially.

Claim 39 (New). Apparatus according to claim 38, wherein the set comprises at least 3 independently controllable Z gradient coils.

Claim 40 (New). Apparatus according to claim 35, further comprising a controllable current supply for providing current independently to the at least two magnetic gradient coils within each coil set.